

What is claimed is:

1. An arrayed waveguide grating comprising:
  - one or plural input waveguides for inputting signal lights;
  - 5 a plurality of output waveguides for outputting signal lights;
  - a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences;
  - 10 an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides; and
  - an output slab waveguide connecting an output end of said channel waveguide array to said output
  - 15 waveguides, and having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to said input waveguides.
2. An arrayed waveguide grating comprising:
  - 20 one or plural input waveguides for inputting signal lights;
  - a plurality of output waveguides for outputting signal lights;
  - a channel waveguide array having waveguides
  - 25 which are successively longer with predetermined waveguide length differences;

an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides; and

an output slab waveguide connecting an output  
5 end of said channel waveguide array to said output waveguides, and having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to said input waveguides depending on the differences between optical losses along  
10 respective paths in the output slab waveguide.

3. An arrayed waveguide grating comprising:

a plurality of input waveguides for inputting signal lights having different wavelengths each other;

15 one or plural output waveguides for outputting signal lights;

a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences;

20 an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides; and

an input slab waveguide connecting an input end of said channel waveguide array to said input  
25 waveguides, and having optical input/output characteris-

tics set to predetermined ratios for the respective input waveguides corresponding to the output waveguides.

4. An arrayed waveguide grating comprising:
- 5 a plurality of input waveguides for inputting signal lights having different wavelengths each other; one or plural output waveguides for outputting signal lights;
- a channel waveguide array having waveguides
- 10 which are successively longer with predetermined waveguide length differences;
- an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides; and
- 15 an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and having optical input/output characteristics set to predetermined ratios for the respective input waveguides corresponding to the output waveguides depending on the differences between optical losses along respective paths in the output slab waveguide.
- 20
5. An arrayed waveguide grating comprising:
- one or plural input waveguides for inputting
- 25 signal lights;

a plurality of output waveguides for outputting signal lights;

a channel waveguide array having waveguides which are successively longer with predetermined  
5 waveguide length differences;

an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides; and

an output slab waveguide connecting an output  
10 end of said channel waveguide array to said output waveguides, said output slab waveguide having a core layer disposed therein for propagating light there-  
through, said core layer being partly cut off in selected or all paths therein which interconnect said channel  
15 waveguide array and said output waveguides, and a cladding layer disposed in cut regions of the core layer and on opposite sides of the core layer, said cut regions in the paths having cut lengths set to predetermined values  
in the direction in which the signal lights propagate,  
20 depending on optical losses of the signal lights propagated in the paths.

6. An arrayed waveguide grating comprising:

a plurality of input waveguides for inputting  
25 signal lights having different wavelengths each other;

one or plural output waveguides for outputting signal lights;

a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences;

an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides; and

an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, said input slab waveguide having a core layer disposed therein for propagating light therethrough, said core layer being partly cut off in selected or all paths therein which interconnect said channel waveguide array and said input waveguides, and a cladding layer disposed in cut regions of the core layer and on opposite sides of the core layer, said cut regions in the paths having cut lengths set to predetermined values in the direction in which the signal lights propagate, depending on optical losses of the signal lights propagated in the paths.

7. An arrayed waveguide grating comprising:

one or plural input waveguides for inputting signal lights;

a plurality of output waveguides for outputting signal lights, said output waveguides having at

least one core layer disposed therein for propagating  
light therethrough, said core layer being partly cut off,  
and a cladding layer disposed in cut regions of the core  
layer and on opposite sides of the core layer, said cut  
5 regions having cut lengths set to predetermined values  
depending on optical losses of the signal lights propa-  
gated in the output waveguides;

a channel waveguide array having waveguides  
which are successively longer with predetermined  
10 waveguide length differences;

an input slab waveguide connecting an input  
end of said channel waveguide array to said input  
waveguides; and

an output slab waveguide connecting an output  
15 end of said channel waveguide array to said output  
waveguides.

8. An arrayed waveguide grating comprising:

a plurality of input waveguides for inputting  
20 signal lights having different wavelengths each other,  
said input waveguides having at least one core layer dis-  
posed therein for propagating light therethrough, said  
core layer being partly cut off, and a cladding layer  
disposed in cut regions of the core layer and on opposite  
25 sides of the core layer, said cut regions having cut  
lengths set to predetermined values depending on optical

losses of the signal lights propagated in the input waveguides;

one or plural output waveguides for outputting signal lights;

5 a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences;

an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides; and

an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides.

15 9. An arrayed waveguide grating comprising:  
one or plural input waveguides for inputting signal lights;

a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences;

20 an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides;

an output slab waveguide connecting an output end of said channel waveguide array to said input end thereof; and

a plurality of output waveguides having respective ends connected to the output end of said output slab waveguide, wherein selected or all of said ends of the output waveguides have respective central positions  
5 displaced from corresponding focused positions in a direction perpendicular to central axes of the output waveguides by predetermined values depending on losses to be given to the signal lights propagated in said output waveguides.

10

10. An arrayed waveguide grating comprising:

a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences;

15 an input slab waveguide having an output end connected to an input end of said channel waveguide array;

one or plural output waveguides for outputting signal lights;

20 an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides; and

a plurality of input waveguides having respective ends connected to the input end of said input slab  
25 waveguide, wherein selected or all of said ends of the input waveguides have respective central positions dis-



placed from corresponding focused positions in a direction perpendicular to central axes of the input waveguides by predetermined values depending on losses to be given to the signal lights propagated in said input  
5 waveguides.

11. An arrayed waveguide grating comprising:
  - a channel waveguide array having waveguides which are successively longer with predetermined  
10 waveguide length differences;
    - an input slab waveguide having an output end connected to an input end of said channel waveguide array;
    - one or plural input waveguides for inputting  
15 signal lights, said input waveguides having output ends connected to an input end of said input slab waveguide;
    - an output slab waveguide having an input end connected to an output end of said channel waveguide array; and
  - 20 a plurality of output waveguides having respective ends connected to the output end of said output slab waveguide, wherein selected or all of central axes of said output waveguides are inclined at the interconnected points of the output waveguides and said output  
25 slab waveguide at respective angles depending on losses

to be given to the signal lights coupled at said interconnected points.

12. An arrayed waveguide grating comprising:
- 5        a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences;
- an input slab waveguide having an output end connected to an input end of said channel waveguide array;
- 10        one or plural output waveguides for outputting signal lights;
- an output slab waveguide connecting an output end of said channel waveguide array to said output
- 15        waveguides; and
- a plurality of input waveguides having respective ends connected to the input end of said input slab waveguide, wherein selected or all of central axes of said input waveguides are inclined at the interconnected
- 20        points of the input waveguides and said input slab waveguide at respective angles depending on losses to be given to the signal lights coupled at said interconnected points.

- 25        13. An arrayed waveguide grating comprising:

a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences;

an input slab waveguide having an output end  
5 connected to an input end of said channel waveguide array;

one or plural input waveguides for inputting signal lights, said input waveguides having output ends connected to an input end of said input slab waveguide;

10 an output slab waveguide having an input end connected to an output end of said channel waveguide array; and

a plurality of output waveguides having respective ends connected to the output end of said output  
15 slab waveguide, wherein selected or all widths of the output waveguides at ends thereof are set to predetermined values depending on losses to be given to the signal lights.

20 14. An arrayed waveguide grating comprising:

a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences;

an input slab waveguide having an output end  
25 connected to an input end of said channel waveguide array;

one or plural output waveguides for outputting signal lights;

an output slab waveguide connecting an output end of said channel waveguide array to said output  
5 waveguides; and

a plurality of input waveguides having respective ends connected to the input end of said input slab waveguide, wherein selected or all widths of the input waveguides at ends thereof are set to predetermined values depending on losses to be given to the signal lights.  
10

15. An arrayed waveguide grating comprising:

a channel waveguide array having waveguides which are successively longer with predetermined  
15 waveguide length differences;

an input slab waveguide having an output end connected to an input end of said channel waveguide array;

one or plural input waveguides for inputting  
20 signal lights, said input waveguides having output ends connected to an input end of said input slab waveguide;

an output slab waveguide having an input end connected to an output end of said channel waveguide array; and

25 a plurality of output waveguides having respective ends connected to the output end of said output

slab waveguide, wherein the lengths between the ends of the output waveguides and said channel waveguide array are displaced in the direction of propagation axes of the output waveguides depending on losses to be given to the signal lights propagated from said channel waveguide array to the ends of the output waveguides.

16. An arrayed waveguide grating comprising:
- a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences;
  - an input slab waveguide having an output end connected to an input end of said channel waveguide array;
  - one or plural output waveguides for outputting signal lights;
  - an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides; and
  - a plurality of input waveguides having respective ends connected to the input end of said input slab waveguide, wherein the lengths between the ends of the input waveguides and said channel waveguide array are displaced in the direction of propagation axes of the input waveguides depending on losses to be given to the

signal lights propagated from said channel waveguide array to the ends of the input waveguides.

17. A demultiplexer comprising:

5 an arrayed waveguide grating comprising one or plural input waveguides for inputting signal lights, a plurality of output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively longer with predetermined waveguide  
10 length differences, an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, said output slab waveguide having optical in-  
15 put/output characteristics set to predetermined ratios for the respective output waveguides with respect to said input waveguides; and

level adjusting means for being supplied with the signal lights of respective wavelengths from the out-  
20 put waveguides of said arrayed waveguide grating, and adjusting output levels of said signal lights to desired values.

18. A demultiplexer comprising:

25 an arrayed waveguide grating comprising one or plural input waveguides for inputting signal lights, a

plurality of output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences, an input slab waveguide connecting an  
5 input end of said channel waveguide array to said input waveguides, and an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, said output slab waveguide having optical input/output characteristics set to predetermined ratios  
10 for the respective output waveguides with respect to said input waveguides depending on the differences between optical losses along respective paths in the output slab waveguide; and

level adjusting means for being supplied with  
15 the signal lights of respective wavelengths from the output waveguides of said arrayed waveguide grating, and adjusting output levels of said signal lights to desired values.

- 20 19. A multiplexer comprising:  
a plurality of light sources;  
an arrayed waveguide grating comprising a plurality of input waveguides for inputting signal lights having different wavelengths each other, one or plural  
25 output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively

longer with predetermined waveguide length differences,  
an output slab waveguide connecting an output end of said  
channel waveguide array to said output waveguides, and an  
input slab waveguide connecting an input end of said  
5 channel waveguide array to said input waveguides, said  
input slab waveguide having optical input/output  
characteristics set to predetermined ratios for the  
respective input waveguides corresponding to the output  
waveguides; level detecting means for detecting levels of  
10 the signal lights input from said light sources to said  
arrayed waveguide grating; and

level adjusting means for comparing the levels  
of the signal lights detected by said level detecting  
means with predetermined levels for the respective wave-  
15 lengths, and adjusting output levels of said light  
sources to set the levels of the waveguides multiplexed  
by said arrayed waveguide grating to desired values.

20. A multiplexer comprising:  
20 a plurality of light sources;  
an arrayed waveguide grating comprising a plu-  
rality of input waveguides for inputting signal lights  
having different wavelengths each other, one or plural  
output waveguides for outputting signal lights, a channel  
25 waveguide array having waveguides which are successively  
longer with predetermined waveguide length differences,



an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, and an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, said  
5 input slab waveguide having optical input/output characteristics set to predetermined ratios for the respective input waveguides with respect to the output waveguides depending on the differences between optical losses along respective paths in the output slab  
10 waveguide; level detecting means for detecting levels of the signal lights input from said light sources to said arrayed waveguide grating; and

level adjusting means for comparing the levels of the signal lights detected by said level detecting  
15 means with predetermined levels for the respective wavelengths, and adjusting output levels of said light sources to set the levels of the waveguides multiplexed by said arrayed waveguide grating to desired values.

- 20 21. An optical communication system comprising:  
optical transmitting means for transmitting optical signals of respective wavelengths parallel to each other;  
a multiplexer for wavelength-division multi-  
25 plexing the optical signals of respective wavelengths transmitted by said light transmitting means;

an optical transmission path for transmitting  
a wavelength-division multiplexed optical signal output  
from said multiplexer;

a node disposed in said optical transmission  
5 path and having an arrayed waveguide grating;

a demultiplexer for being supplied with the  
optical signal transmitted over said optical transmission  
path via said node and demultiplexing the optical signal  
into the optical signals of respective wavelengths; and

10 optical receiving means for receiving the op-  
tical signals of respective wavelengths demultiplexed by  
said demultiplexer;

said multiplexer comprising an arrayed  
waveguide grating comprising a plurality of input  
15 waveguides for inputting signal lights having different  
wavelengths from said light source, one or plural output  
waveguides for outputting signal lights, a channel  
waveguide array having waveguides which are successively  
longer with predetermined waveguide length differences,  
20 an output slab waveguide connecting an output end of said  
channel waveguide array to said output waveguides, and an  
input slab waveguide connecting an input end of said  
channel waveguide array to said input waveguides, and  
having optical input/output characteristics set to prede-  
25 termined ratios for the respective input waveguides with  
respect to the output waveguides;

said demultiplexer comprising an arrayed waveguide grating comprising one or plural input waveguides for inputting signal lights, a plurality of output waveguides for outputting signal lights, a channel  
5 waveguide array having waveguides which are successively longer with predetermined waveguide length differences, an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and an output slab waveguide connecting an output end of said  
10 channel waveguide array to said output waveguides, and having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to said input waveguides.

- 15           22. An optical communication system comprising:  
            optical transmitting means for transmitting optical signals of respective wavelengths parallel to each other;  
            a multiplexer for wavelength-division multi-  
20 plexing the optical signals of respective wavelengths transmitted by said light transmitting means;  
            an optical transmission path for transmitting a wavelength-division multiplexed optical signal output from said multiplexer;  
25           a node disposed in said optical transmission path and having an arrayed waveguide grating;

a demultiplexer for being supplied with the optical signal transmitted over said optical transmission path via said node and demultiplexing the optical signal into the optical signals of respective wavelengths; and

5 optical receiving means for receiving the optical signals of respective wavelengths demultiplexed by said demultiplexer;

said multiplexer comprising an arrayed waveguide grating comprising a plurality of input  
10 waveguides for inputting signal lights having different wavelengths, one or plural output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences, an output slab  
15 waveguide connecting an output end of said channel waveguide array to said output waveguides, and an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and having optical input/output characteristics set to predetermined  
20 ratios for the respective input waveguides with respect to the output waveguides depending on the differences between optical losses along respective paths in the output slab waveguide;

said demultiplexer comprising an arrayed  
25 waveguide grating comprising one or plural input waveguides for inputting signal lights, a plurality of

output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences, an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, and having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to said input waveguides depending on the differences between optical losses along respective paths in the output slab waveguide.

23. An optical communication system comprising:
- an annular transmission path having a plurality of nodes interconnected in a ring by a transmission path, for transmitting a wavelength-division multiplexed optical signal over the transmission path;
- each of said nodes having a first arrayed waveguide grating for demultiplexing a wavelength-division multiplexed optical signal into optical signals of respective wavelengths, and a second arrayed waveguide grating for wavelength-division multiplexing the demultiplexed optical signals of respective wavelengths;
- said first arrayed waveguide grating comprising one or plural input waveguides for inputting signal

lights, a plurality of output waveguides for outputting  
signal lights, a channel waveguide array having  
waveguides which are successively longer with predeter-  
mined waveguide length differences, an input slab  
5 waveguide connecting an input end of said channel  
waveguide array to said input waveguides, and an output  
slab waveguide connecting an output end of said channel  
waveguide array to said output waveguides, and having op-  
tical input/output characteristics set to predetermined  
10 ratios for the respective output waveguides with respect  
to said input waveguides;

said second arrayed waveguide grating compris-  
ing a plurality of input waveguides for inputting signal  
lights having different wavelengths each other, one or  
15 plural output waveguides for outputting signal lights, a  
channel waveguide array having waveguides which are suc-  
cessively longer with predetermined waveguide length dif-  
ferences, an output slab waveguide connecting an output  
end of said channel waveguide array to said output  
20 waveguides, and an input slab waveguide connecting an in-  
put end of said channel waveguide array to said input  
waveguides, and having optical input/output characteris-  
tics set to predetermined ratios for the respective input  
waveguides corresponding to the output waveguides.

25

24. An optical communication system comprising:

an annular transmission path having a plurality of nodes interconnected in a ring by a transmission path, for transmitting a wavelength-division multiplexed optical signal over the transmission path;

5 each of said nodes having a first arrayed waveguide grating for demultiplexing a wavelength-division multiplexed optical signal into optical signals of respective wavelengths, and a second arrayed waveguide grating for multiplexing the demultiplexed optical signals of respective wavelengths;

10

said first arrayed waveguide grating comprising one or plural input waveguides for inputting signal lights, a plurality of output waveguides for outputting signal lights, a channel waveguide array having

15 waveguides which are successively longer with predetermined waveguide length differences, an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and an output slab waveguide connecting an output end of said channel

20 waveguide array to said output waveguides, and having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to said input waveguides depending on the differences between optical losses along respective paths in the output

25 slab waveguide;

said second arrayed waveguide grating comprising a plurality of input waveguides for inputting signal lights having different wavelengths each other, one or plural output waveguides for outputting signal lights, a  
5 channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences, an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, and an input slab waveguide connecting an input  
10 put end of said channel waveguide array to said input waveguides, and having optical input/output characteristics set to predetermined ratios for the respective input waveguides corresponding to the output waveguides depending on the differences between optical losses along respective  
15 spective paths in the output slab waveguide.

25. An optical communication system comprising:  
optical transmitting means for transmitting optical signals of respective wavelengths parallel to  
20 each other;  
a multiplexer for wavelength-division multiplexing the optical signals of respective wavelengths transmitted by said light transmitting means;  
an optical transmission path for transmitting  
25 a wavelength-division multiplexed optical signal output from said multiplexer;



a node disposed in said optical transmission path;

a demultiplexer for being supplied with the optical signal transmitted over said optical transmission path via said node and demultiplexing the optical signal  
5 into the optical signals of respective wavelengths; and

optical receiving means for receiving the optical signals of respective wavelengths demultiplexed by said demultiplexer;

10 said multiplexer comprising an arrayed waveguide grating having a plurality of input waveguides for inputting signal lights having different wavelengths, one or plural output waveguides for outputting signal lights, a channel waveguide array having waveguides which  
15 are successively longer with predetermined waveguide length differences, an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, and an input slab waveguide connecting an input end of said channel waveguide array to said in-  
20 put waveguides, and having optical input/output characteristics set to predetermined ratios for the respective input waveguides corresponding to the output waveguides; level detecting means for detecting levels of the signal lights input to said arrayed waveguide  
25 grating; and level adjusting means for comparing the levels of the signal lights detected by said level detecting means with predetermined levels for the

terminated levels for the respective wavelengths, and adjusting output levels of the light signals to set the levels of the waveguides multiplexed by said arrayed waveguide grating to desired values;

- 5           said demultiplexer comprising an arrayed waveguide grating comprising one or plural input waveguides for inputting signal lights, a plurality of output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively  
10 longer with predetermined waveguide length differences, an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, and  
15 having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to said input waveguides; and level adjusting means for being supplied with the signal lights of respective wavelengths from the output waveguides of said  
20 arrayed waveguide grating, and adjusting output levels of said signal lights to desired values.

26. An optical communication system comprising:  
optical transmitting means for transmitting  
25 optical signals of respective wavelengths parallel to each other;

a multiplexer for wavelength-division multiplexing the optical signals of respective wavelengths transmitted by said light transmitting means;

an optical transmission path for transmitting  
5 a wavelength-division multiplexed optical signal output from said multiplexer;

a node disposed in said optical transmission path;

a demultiplexer for being supplied with the  
10 optical signal transmitted over said optical transmission path via said node and demultiplexing the optical signal into the optical signals of respective wavelengths; and

optical receiving means for receiving the optical signals of respective wavelengths demultiplexed by  
15 said demultiplexer;

said multiplexer comprising an arrayed waveguide grating comprising a plurality of input waveguides for inputting signal lights having different wavelengths, one or plural output waveguides for output-  
20 ting signal lights, a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences, an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, and an input  
25 slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and having op-

tical input/output characteristics set to predetermined ratios for the respective input waveguides corresponding to the output waveguides depending on the differences between optical losses along respective paths in the output slab waveguide; level detecting means for detecting levels of the signal lights input to said arrayed waveguide grating; and level adjusting means for comparing the levels of the signal lights detected by said level detecting means with predetermined levels for the respective wavelengths, and adjusting output levels of the signal lights to set the levels of the waveguides multiplexed by said arrayed waveguide grating to desired values;

said demultiplexer comprising an arrayed waveguide grating comprising one or plural input waveguides for inputting signal lights, a plurality of output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences, an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, and having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to said input waveguides depending on the differences between optical losses along respective paths in

the output slab waveguide; and level adjusting means for being supplied with the signal lights of respective wavelengths from the output waveguides of said arrayed waveguide grating, and adjusting output levels of said  
5 signal lights to desired values.

27. An optical communication system comprising:  
an annular transmission path having a plurality of nodes interconnected in a ring by a transmission  
10 path, for transmitting a wavelength-division multiplexed optical signal over the transmission path;

each of said nodes having a demultiplexer for demultiplexing a wavelength-division multiplexed optical signal into optical signals of respective wavelengths,  
15 and a multiplexer for wavelength-division multiplexing the demultiplexed optical signals of respective wavelengths;

said demultiplexer comprising an arrayed waveguide grating comprising one or plural input  
20 waveguides for inputting signal lights, a plurality of output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences, an input slab waveguide connecting an input end of said  
25 channel waveguide array to said input waveguides, and an output slab waveguide connecting an output end of said

channel waveguide array to said output waveguides, and having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to said input waveguides; and level adjusting means for being supplied with the signal lights of respective wavelengths from the output waveguides of said arrayed waveguide grating, and adjusting output levels of said signal lights to desired values;

said multiplexer comprising an arrayed

10 waveguide grating having a plurality of input waveguides for inputting signal lights having different wavelengths, one or plural output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively longer with predetermined waveguide

15 length differences, an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, and an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and having optical input/output

20 characteristics set to predetermined ratios for the respective input waveguides corresponding to the output waveguides; level detecting means for detecting levels of the signal lights input to said arrayed waveguide grating; and level adjusting means for comparing the

25 levels of the signal lights detected by said level detecting means with predetermined levels for the respective wavelengths, and adjusting output levels of

justing output levels of the light signals to set the levels of the waveguides multiplexed by said arrayed waveguide grating to desired values.

- 5           28. An optical communication system comprising:  
            an annular transmission path having a plurality of nodes interconnected in a ring by a transmission path, for transmitting a wavelength-division multiplexed optical signal over the transmission path;
- 10           each of said nodes having a demultiplexer for demultiplexing a wavelength-division multiplexed optical signal into optical signals of respective wavelengths, and a multiplexer for frequency-division multiplexing the demultiplexed optical signals of respective wavelengths;
- 15           said demultiplexer comprising an arrayed waveguide grating comprising one or plural input waveguides for inputting signal lights, a plurality of output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively
- 20           longer with predetermined waveguide length differences, an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, and
- 25           having optical input/output characteristics set to predetermined ratios for the respective output waveguides with

respect to said input waveguides depending on the differences between optical losses along respective paths in the output slab waveguide; and level adjusting means for being supplied with the signal lights of respective wavelengths from the output waveguides of said arrayed waveguide grating, and adjusting output levels of said signal lights to desired values;

said multiplexer comprising an arrayed waveguide grating comprising a plurality of input waveguides for inputting signal lights having different wavelengths, one or plural output waveguides for outputting signal lights, a channel waveguide array having waveguides which are successively longer with predetermined waveguide length differences, an output slab waveguide connecting an output end of said channel waveguide array to said output waveguides, and an input slab waveguide connecting an input end of said channel waveguide array to said input waveguides, and having optical input/output characteristics set to predetermined ratios for the respective input waveguides corresponding to the output waveguides depending on the differences between optical losses along respective paths in the output slab waveguide; level detecting means for detecting levels of the signal lights input to said arrayed waveguide grating; and level adjusting means for comparing the levels of the signal lights detected by said level detecting



means with predetermined levels for the respective wavelengths, and adjusting output levels of the signal lights to set the levels of the waveguides multiplexed by said arrayed waveguide grating to desired values.

5

29. A waveguide device comprising:

one or plural input waveguides for inputting signal lights;

a plurality of output waveguides for outputting signal lights; and

10 a slab waveguide having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to the input waveguides.

15

30. A waveguide device comprising:

a plurality of input waveguides for inputting signal lights;

one or plural output waveguides for outputting signal lights; and

20 a slab waveguide having optical input/output characteristics set to predetermined ratios for the respective input waveguides with respect to the output waveguides.

25

31. A waveguide device comprising:

one or plural input waveguides for inputting  
signal lights;

a plurality of output waveguides for output-  
ting signal lights; and

5 a slab waveguide connecting the input  
waveguides to the output waveguides, said slab waveguide  
having a core layer disposed therein for propagating  
light therethrough from said input waveguides to the out-  
put waveguides, said core layer being partly cut off in  
10 selected or all paths therein which interconnect said in-  
put waveguides and said output waveguides, and a cladding  
layer disposed in cut regions of the core layer and on  
opposite sides of the core layer, said cut regions in the  
paths having cut lengths set to predetermined values in  
15 the direction in which the signal lights propagate, de-  
pending on optical losses of the signal lights propagated  
in the paths.

32. A waveguide device comprising:

20 a plurality of input waveguides for inputting  
signal lights;

one or plural output waveguides for outputting  
signal lights; and

25 a slab waveguide connecting the input  
waveguides to the output waveguides, said slab waveguide  
having a core layer disposed therein for propagating

light therethrough from said input waveguides to the out-  
put waveguides, said core layer being partly cut off in  
selected or all paths therein which interconnect said in-  
put waveguides and said output waveguides, and a cladding  
5 layer disposed in cut regions of the core layer and on  
opposite sides of the core layer, said cut regions in the  
paths having cut lengths set to predetermined values in  
the direction in which the signal lights propagate, de-  
pending on optical losses of the signal lights propagated  
10 in the paths.

33. A waveguide device comprising:  
one or plural input waveguides for inputting  
signal lights;  
15 a slab waveguide having an input end connected  
to said input waveguides; and  
an output waveguide having a plurality of  
waveguides connected to an output end of said slab  
waveguide, wherein each of selected or all of the  
20 waveguides have a core layer disposed therein for propa-  
gating light therethrough, said core layer being partly  
cut off, and a cladding layer disposed in cut regions of  
the core layer and on opposite sides of the core layer,  
said cut regions having cut lengths set to predetermined  
25 values depending on optical losses of the signal lights  
propagated in the waveguides.

34. A waveguide device comprising:  
an input waveguide having a plurality of  
waveguides for inputting signal lights, wherein each of  
5 selected or all of the waveguides have a core layer dis-  
posed therein for propagating light therethrough, said  
core layer being partly cut off, and a cladding layer  
disposed in cut regions of the core layer and on opposite  
sides of the core layer, said cut regions having cut  
10 lengths set to predetermined values depending on optical  
losses of the signal lights propagated in the waveguides;  
one or plural output waveguides for outputting  
signal lights; and  
a slab waveguide interconnecting said input  
15 waveguides and said output waveguides.

35. A waveguide device comprising:  
one or plural input waveguides for inputting  
signal lights;  
20 a slab waveguide having an input end connected  
to output ends of said input waveguides; and  
an output waveguide having a plurality of  
waveguides connected to an output end of said slab  
waveguide, wherein selected or all of the waveguides have  
25 ends having respective central positions displaced from  
corresponding focused positions in a direction perpen-

dicular to central axes of the waveguides by predetermined values depending on losses to be given to the signal lights propagated in said waveguides.

5        36. A waveguide device comprising:

        a slab waveguide;

        an output waveguide connected to an output end of said slab waveguide; and

        a plurality of input waveguides having respective ends connected to an input end of said slab waveguide, wherein selected or all of said ends have respective central positions displaced from corresponding focused positions in a direction perpendicular to central axes of the input waveguides by predetermined values depending on losses to be given to the signal lights propagated in said output waveguides.

        37. A waveguide device comprising:

        one or plural input waveguides for inputting signal lights;

        a slab waveguide having an input end connected to output ends of said input waveguides; and

        a plurality of output waveguides having respective ends connected to an output end of said slab waveguide, wherein selected or all of central axes of said output waveguides are inclined at the interconnected

points of the output waveguides and said slab waveguides at respective angles depending on losses to be given to the signal lights coupled at said interconnected points.

5 38. A waveguide device comprising:  
one or plural output waveguides for outputting signal lights;

a slab waveguide having an output end connected to input ends of said output waveguides; and  
10 a plurality of input waveguides having respective ends connected to an input end of said slab waveguide, wherein selected or all of central axes of said input waveguides are inclined at the interconnected points of the input waveguides and said slab waveguides  
15 at respective angles depending on losses to be given to the signal lights coupled at said interconnected points.

39. A waveguide device comprising:  
one or plural input waveguides for inputting  
20 signal lights;  
a slab waveguide having an input end connected to output ends of said input waveguides; and  
a plurality of output waveguides having respective ends connected to an output end of said slab  
25 waveguide, wherein selected or all of said ends have

waveguide widths set to values depending on losses to be given to the signal lights.

5 40. A waveguide device comprising:  
one or plural output waveguides for outputting signal lights;

a slab waveguide having an output end connected to input ends of said output waveguides; and  
10 a plurality of input waveguides having respective ends connected to an input end of said slab waveguide, wherein selected or all of said ends have waveguide widths set to values depending on losses to be given to the signal lights.

15 41. A waveguide device comprising:  
one or plural input waveguides for inputting signal lights;

a slab waveguide having an input end connected to output ends of said input waveguides; and  
20 a plurality of output waveguides having respective ends connected to an output end of said slab waveguide, wherein the lengths between the ends of the output waveguides and said input waveguides are displaced in the direction of propagation axes of the output  
25 waveguides depending on losses to be given to the signal

lights propagated from said input waveguides to the ends of the output waveguides.

42. A waveguide device comprising:

5 one or plural output waveguides for outputting signal lights;

a slab waveguide having an output end connected to input ends of said output waveguides; and

10 a plurality of input waveguides having respective ends connected to an input end of said slab waveguide, wherein the lengths between the ends of the output waveguides and said input waveguides are displaced in the direction of propagation axes of the output waveguides depending on losses to be given to the signal lights propagated from said output waveguides to the ends of the input waveguides.

43. A demultiplexer comprising:

20 a waveguide device having one or plural input waveguides for inputting signal lights, a plurality of output waveguides for outputting signal lights, and a slab waveguide having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to the input waveguides; and  
25 level adjusting means for being supplied with signal lights output from the output waveguides of said



waveguide device, and adjusting output levels of the signal lights to desired values.

44. A multiplexer comprising:

5 a plurality of light sources for respective signals;

a waveguide device having a plurality of input waveguides for inputting signal lights, one or plural output waveguides for outputting signal lights, and a  
10 slab waveguide having optical input/output characteristics set to predetermined ratios for the respective input waveguides with respect to the output waveguides;

level detecting means for detecting levels of the signal lights input from said light sources to said  
15 waveguide device; and

level adjusting means for comparing the levels of the signal lights detected by said level detecting means with predetermined levels for the respective signal lights, and adjusting output levels of the respective  
20 signal lights to set the levels of the signal lights wavelength-division multiplexed by said waveguide device to desired values.

45. An optical communication system comprising:

optical transmitting means for transmitting optical signals of respective wavelengths parallel to each other;

a multiplexer for wavelength-division multiplexing the optical signals of respective wavelengths transmitted by said light transmitting means;

an optical transmission path for transmitting a wavelength-division multiplexed optical signal output from said multiplexer;

10 a node disposed in said optical transmission path and having a waveguide device;

a demultiplexer for being supplied with the optical signal transmitted over said optical transmission path via said node and demultiplexing the optical signal into the optical signals of respective wavelengths; and

15 optical receiving means for receiving the optical signals of respective wavelengths demultiplexed by said demultiplexer;

said multiplexer comprising a plurality of input waveguides for inputting signal lights, one or plural output waveguides for outputting signal lights, and a slab waveguide having optical input/output characteristics set to predetermined ratios for the respective input waveguides with respect to the output waveguides;

20 said demultiplexer comprising a waveguide device comprising one or plural input waveguides for input-

ting signal lights, a plurality of output waveguides for  
outputting signal lights, and a slab waveguide having op-  
tical input/output characteristics set to predetermined  
ratios for the respective output waveguides with respect  
5 to said input waveguides.

46. An optical communication system comprising:  
an annular transmission path having a plural-  
ity of nodes interconnected in a ring by a transmission  
10 path, for transmitting a wavelength-division multiplexed  
optical signal over the transmission path;

each of said nodes having a first waveguide  
device for demultiplexing a wavelength-division multi-  
plexed optical signal into optical signals of respective  
15 wavelengths, and a second waveguide device for wave-  
length-division multiplexing the demultiplexed optical  
signals of respective wavelengths;

said first waveguide device comprising one or  
plural input waveguides for inputting signal lights, a  
20 plurality of output waveguides for outputting signal  
lights, and a slab waveguide having optical input/output  
characteristics set to predetermined ratios for the re-  
spective output waveguides with respect to said input  
waveguides;

25 said second waveguide device comprising a plu-  
rality of input waveguides for inputting signal lights,

one or plural output waveguides for outputting signal lights, and a slab waveguide having optical input/output characteristics set to predetermined ratios for the respective input waveguides with respect to the output waveguides.

47. An optical communication system comprising:  
optical transmitting means for transmitting optical signals of respective wavelengths parallel to each other;  
a multiplexer for wavelength-division multiplexing the optical signals of respective wavelengths transmitted by said light transmitting means;  
an optical transmission path for transmitting a wavelength-division multiplexed optical signal output from said multiplexer;  
a node disposed in said optical transmission path;  
a demultiplexer for being supplied with the optical signal transmitted over said optical transmission path via said node and demultiplexing the optical signal into the optical signals of respective wavelengths; and  
optical receiving means for receiving the optical signals of respective wavelengths demultiplexed by said demultiplexer;

said multiplexer comprising a plurality of  
light sources for respective signals, a waveguide device  
having a plurality of input waveguides for inputting sig-  
nal lights, one or plural output waveguides for output-  
5   ting signal lights, and a slab waveguide having optical  
input/output characteristics set to predetermined ratios  
for the respective input waveguides with respect to the  
output waveguides; level detecting means for detecting  
levels of the signal lights input from said light sources  
10   to said waveguide device; and level adjusting means for  
comparing the levels of the signal lights detected by  
said level detecting means with predetermined levels for  
the respective signal lights, and adjusting output levels  
of the respective signal lights to set the levels of the  
15   signal lights multiplexed by said waveguide device to de-  
sired values;

said demultiplexer comprising a waveguide de-  
vice having one or plural input waveguides for inputting  
signal lights, a plurality of output waveguides for out-  
20   putting signal lights, and a slab waveguide having opti-  
cal input/output characteristics set to predetermined ra-  
tios for the respective output waveguides with respect to  
the input waveguides; and level adjusting means for being  
supplied with the signal lights from the output  
25   waveguides of said waveguide device, and adjusting output  
levels of said signal lights to desired values.

48. An optical communication system comprising:  
an annular transmission path having a plurality of nodes interconnected in a ring by a transmission path, for transmitting a wavelength-division multiplexed optical signal over the transmission path;  
each of said nodes having a demultiplexer for demultiplexing a multiplexed optical signal into optical signals of respective wavelengths, and a multiplexer for wavelength-division multiplexing the demultiplexed optical signals of respective wavelengths;  
said demultiplexer comprising a waveguide device having one or plural input waveguides for inputting signal lights, a plurality of output waveguides for outputting signal lights, and a slab waveguide having optical input/output characteristics set to predetermined ratios for the respective output waveguides with respect to the input waveguides; and level adjusting means for being supplied with the signal lights from the output waveguides of said waveguide device, and adjusting output levels of said signal lights to desired values; and  
said multiplexer comprising a plurality of light sources for respective signals, a waveguide device having a plurality of input waveguides for inputting signal lights, one or plural output waveguides for outputting signal lights, and a slab waveguide having optical

input/output characteristics set to predetermined ratios  
for the respective input waveguides with respect to the  
output waveguides; level detecting means for detecting  
levels of the signal lights input from said light sources  
5 to said waveguide device; and level adjusting means for  
comparing the levels of the signal lights detected by  
said level detecting means with predetermined levels for  
the respective signal lights, and adjusting output levels  
of the respective signal lights to set the levels of the  
10 signal lights multiplexed by said waveguide device to de-  
sired values.